

IN THE CLAIMS

Please amend the claims according to the following listing, in which insertions are indicated by underline and deletions are indicated by strikethrough or double brackets. This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently amended) A casting die made of a steel material, wherein a compressive residual stress of a cavity surface is larger than 1000 MPa, a maximum height of roughness of the cavity surface is not more than 16 μm , and a nitrided layer is provided at a surface layer of said cavity surface.
2. (Previously Presented) The casting die according to claim 1, wherein a Vickers hardness of said cavity surface is not less than 700, a thickness of said nitrided layer is not less than 0.03 mm, and said steel material is alloy tool steel.
3. (Previously Presented) The casting die according to claim 1, wherein a Vickers hardness of said cavity surface is not less than 700, a thickness of said nitrided layer is not less than 0.1 mm, and said steel material is chrome molybdenum steel.
4. (Previously Presented) The casting die according to claim 1, wherein said compressive residual stress of said cavity surface is larger than 1200 MPa, and said maximum height is not more than 8 μm .
5. (Previously Presented) The casting die according to claim 1, wherein said nitrided layer contains iron sulfide.

6. (Currently Amended) A surface treatment method of a casting die made of a steel material, comprising applying a shot peening treatment and a nitriding treatment to at least a cavity surface of said casting die so that a maximum height of roughness of said cavity surface is not more than 16 μm , and a compressive residual stress is larger than 1000 MPa.
7. (Previously Presented) The surface treatment method of said casting die according to claim 6, wherein said nitriding treatment is performed after applying said shot peening treatment.
8. (Currently Amended) The surface treatment method of said casting die according to claim 7, wherein said shot peening treatment is carried out again after applying said nitriding treatment so that said maximum height of roughness of said cavity surface is not more than 8 μm , and said compressive residual stress is larger than 1200 MPa.
9. (Previously Presented) The surface treatment method of said casting die according to claim 6, wherein said nitriding treatment is a sulphonitriding treatment or a gas nitriding treatment using nitriding gas.
10. (Previously Presented) The surface treatment method of said casting die according to claim 6, wherein said surface treatment method is applied to said casting die after the die has been used for casting operation.
11. (Previously Presented) The casting die according to claim 2, wherein said nitrided layer contains iron sulfide.

12. (Previously Presented) The casting die according to claim 3, wherein said nitrided layer contains iron sulfide.

13. (Previously Presented) The surface treatment method of said casting die according to claim 8, wherein said surface treatment method is applied to said casting die after the die has been used for casting operation.

14. (New) The surface treatment method of said casting die according to claim 6, wherein hydrogen gas is applied to said cavity surface during said nitriding treatment.

15. (New) The casting die according to claim 5, wherein the nitrided layer is a compound diffusion layer containing both iron sulfide and iron nitride.

16. (New) The surface treatment method of said casting die according to claim 6, wherein ammonia gas, hydrogen sulfide gas, and hydrogen gas are applied to said cavity surface during said nitriding treatment to form a compound diffusion layer containing both iron sulfide and iron nitride.

17. (New) A steel die for use in casting metal workpieces, the die having a cavity surface formed therein and being a product of a process comprising the steps of:

a) performing a coarse peening step;

b) after the coarse peening step, applying a gaseous mixture comprising a sulfurizing gas and a nitriding gas to the cavity surface of the die in a processing chamber

under controlled temperature conditions to form a sulphonitrided diffusion layer thereon;
and

c) subsequently, performing a finishing peening step;

wherein a residual stress of the cavity surface is larger than 1200 MPa, and a maximum height of roughness of the cavity surface is not more than 8 μm .

18. (New) The steel die of claim 17, wherein the coarse peening step comprises applying water-borne ceramic particles to the cavity surface of the die, the ceramic particles having particle diameters between 200 and 220 mesh, and wherein the fine peening step comprises applying water-borne glass particles to the cavity surface of the die, the glass particles having particle diameters between 200 and 220 mesh.

19. (New) The steel die of claim 17, wherein the temperature in the processing chamber is maintained in a range between 505 degrees Celsius and 580 degrees Celsius during the gaseous mixture application step.

20. (New) The steel die of claim 17, wherein the gaseous mixture comprises ammonia gas, hydrogen sulfide gas, and hydrogen gas.